

### REMARKS

Applicant acknowledges with appreciation the Examiner's allowance of claims 12-22. Applicant also acknowledges the Examiner's indication of allowability of claims 27 and 40-46 if rewritten in independent form including the limitations of base claims. Claims 11, 32 and 33 are amended. Claims 1-48 are pending in the present application.

Claims 11 and 32-36 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Applicants respectfully traverse this rejection.

The Office Action asserts that the term "transparent opening" lacks sufficient antecedent basis for the limitation in claim 11. (Office Action at 3). It also asserts that the term "said bars" lacks sufficient antecedent basis in claim 32 and the term "said layer of transparent material" lacks sufficient antecedent basis in claim 33. Claim 11 has been amended to recite, in part, "said layer of phase-shifting material being located between said transparent hole and partially transmissive frame." Claim 32 has been amended to recite, in part, "wherein phase-shifted light transmitted through one of said bar-shaped partially transmissive assist features." Claim 33 has been amended to recite, in part, "said mask comprising: a layer of transparent material; a layer of opaque material." Claims 11, 32 and 33 are in compliance of 35 U.S.C. § 112, second paragraph. Claims 34 -36 depend on claim 33 and are also in compliance of 35 U.S.C. § 112, second paragraph. Applicants respectfully request that the rejection of claims 11 and 32-36 be withdrawn.

Claims 28-30 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,294,295 ("Lin et al."). Applicants respectfully traverse this rejection.

Claim 28 recites a mask for forming an array of sub-resolution features comprising, inter alia, "a layer of light-obstructing material; and a layer of attenuating phase shifting material located between said layer of transparent material and said layer of light-obstructing material; and wherein said layer of light-obstructing material and said layer of attenuating phase shifting material are patterned to form transparent holes and

light-obstructing frames surrounding said transparent holes.” Lin et al. fails to disclose this structure.

Lin et al. discloses a patterned layer of phase shifting material (124) surrounding holes (118). (Col. 4, lines 29-37; Figs. 4 and 5). A patterned layer of opaque material (126) defines rims (119) of the phase shifting material (124). (Col. 4, lines 40-43; Figs. 4 and 5). The Office Action at 4, line 6, uses “opaque” interchangeably with “light-obstructing.” The Office Action at 4, lines 10-11, then differentiates between “transparent”, “light-obstructing” and “attenuating phase-shifting.” The Office Action then asserts, however, at 4, lines 14-15, that “light-obstructing” may be construed as being “partially transparent” and uses this assumption to conclude that the contact-hole-with-partially-transparent-frame of Lin et al. anticipates the “light-obstructing frames surrounding transparent holes” of the claimed invention. Applicants respectfully submit that this Office Action’s assertion is internally inconsistent and contrary to the differentiation between transmissive and opaque. That is, if “partially transmissive” is considered “light-obstructing,” while “light-obstructing” is used interchangeably with “opaque,” then it would follow that “partially transparent” also means “opaque,” which cannot be the case.

Lin et al. specifically discloses two different materials: an opaque material and a phase shifting material. Lin uses a phase shifting material to surround the holes, and not a light-obstructing frame, as recited in claim 28. Since Lin et al. does not disclose all the limitations of claim 28, it does not anticipate claim 28. Claims 29-30 depend from claim 28. Therefore, claims 28-30 are patentable over the reference. Applicants respectfully request that the 35 U.S.C. § 102(b) rejection of claims 28-30 be withdrawn.

Claims 37-39 and 47 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,447,810 (“Chen et al.”). Applicants respectfully traverse this rejection.

Claim 37 recites a method of making a multi-tone microlithographic mask comprising “providing sets of dimension data representative of mask patterns; for each set of dimension data, calculating feature dimension data as a function of optical conditions; and for a desired optical condition, identifying the sets of dimension data that have feature dimension data within desired limits.” Chen et al. does not disclose all the limitations of this claim.

Chen et al. discloses selecting an optimal separation distance between the scattering bar (213) and the isolated edge (211), then selecting optimal width of the scattering bar while using the selected optimum separation. (Col. 4, lines 22-30; Figs. 6A-6E). Chen et al. further discloses determining optimum separation for scattering bars empirically, by repeatedly exposing the scattering bars while changing the separation of the scattering bar for each exposure to create sets of data for a scattering bar of a certain width at different defocus settings. (Col. 6, lines 52-56; Col. 8, lines 12-16; Col. 8, lines 65-66). The critical dimensions are measured and entered into tables. (Col. 7, lines 1-13; Table 1; Col. 8, lines 65-68; Table 2). Thus, Chen et al. discloses selection of scattering bar dimensions based on experimentation with varying scattering bar widths, scattering bar separations, and defocus settings. Chen et al. does not disclose the advantage of calculating feature dimension data as a function of optical conditions, as in the claimed invention.

Since Chen et al. does not disclose all the limitations of claim 37, it does not anticipate claim 37. Claims 38, 39, and 47 from claim 37. Therefore, claims 37-39 and 47 are patentable over the reference. Applicants respectfully request that the 35 U.S.C. § 102(b) rejection of claims 37-39 and 47 be withdrawn.

Claims 1-11, 23-26 and 31-36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin et al. in view of Chen et al. Applicants respectfully traverse this rejection.

Claims 1, 23 and 31 recite similar limitations to those of claim 28. For example, claim 1 recites, in part, “a partially transmissive assist feature, and a light-obstructing frame located between said transparent hole and said partially transmissive assist feature;” claim 23 recites, in part, “an opaque frame surrounding said opening;” and claim 31 recites, in part, “a second layer of material for preventing incident light from propagating through said first layer, said second layer including frames surrounding openings.” Lin et al. and Chen et al., whether considered alone or in combination, do not teach or suggest all the limitations of claims 1, 23 and 31.

For at least the same reasoning set forth above regarding the patentability of claim 28, as not being anticipated by Lin et al., Lin et al. would not have rendered the subject matter of claims 1, 23 and 31 obvious (i.e., Lin et al. does not disclose light-obstructing material surrounding an opening). Chen et al. cannot supplement the inadequacies of Lin et al. in this respect. Chen et al. recites a mask, whereby “proximity effect problems and depth-of-focus differences between packed and isolated features are reduced by disposing additional lines, referred to as scattering bars, adjacent to isolated feature edges in the mask.” (Col. 3, lines 62-65). According to Chen et al., “[t]he scattering bars are the same transparency as the original feature.” Therefore, the Chen et al. invention has only a mask with transparent features and does not teach the use of a transparent layer, a phase shifting layer, and a light-obstructing layer.

Since Lin et al. and Chen et al., taken individually or in combination, fail to teach or suggest all the limitations of independent claims 1, 23 and 31, these claims and respective dependent claims 2-11, 24-26, and 32-36 are patentable over the references. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of these claims be withdrawn.

Claim 48 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen et al. in view of Lin et al. Applicants respectfully traverse this rejection.

Claim 48 depends from claim 37. For at least the same reasoning set forth above regarding the patentability of claim 37 as not anticipated by Chen et al., Chen et al. would not have rendered the subject matter of claim 37 obvious (i.e., Chen et al. does not disclose calculating feature dimension data as a function optical conditions). Lin et al. cannot supplement the inadequacies of Chen et al. in this respect. While Lin et al. discloses a method of forming an attenuating phase shifting mask, including exposing phase shifting material to remove portions material, creating holes, and treating it with solutions (cols. 5-6), Lin et al. makes no mention of how the dimensions of the desired mask is determined. In fact, Lin et al. is entirely silent on the calculation of feature dimension data.

Since Chen et al. and Lin et al., taken individually or in combination, fail to teach or suggest all the limitations of independent claim 37, dependent claim 48 is patentable over the references. Applicant respectfully requests that the 35 U.S.C. § 103(a) rejection of this claim be withdrawn.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

By 

Mark J. Thronson

Registration No.: 33,082

DICKSTEIN SHAPIRO MORIN &  
OSHINSKY LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorney for Applicants